6-8 years

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Science Content:
Physical Science

Target Concepts/Skills:
transparency /translucency/opacity

Target Age group:
6 - 8 years

Duration of activity:
3 lessons

Summary:
This activity involves the exploration of how shadows are produced by investigating the shadows made by different objects and observing shadows over the course of a day. The first investigation involves children inquiring the shape, size and colour of a shadow formed. The second inquiry focuses on how the shadow of an object changes during the course of a day.

Objective:
By the end of the activity children should be able to:

- Demonstrate how a shadow is formed;
- Distinguish between shadows formed by translucent and opaque materials;
- Investigate the shape of the shadow formed by different objects;
- Investigate how the size, shape and orientation of a shadow varies with the time of day according to the sun's orientation.

Resources:

- A range of transparent, translucent and opaque materials of different colours and thicknesses;
- Torches;
- Drawing paper;
- Pencils, rulers;
- Cameras.

The world around us:
exploring shadows, day and night

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1. Engage (Forming hypotheses)

Decide which question to investigate (= the challenge)
What do children already know? What are their ideas? (make the question to investigate meaningful for the children)

Starter/ stimulus to elicit pupils' prior knowledge
Noticing/observing shadows e.g. Overhead projector or other bright lamp and an object creating a shadow, shadows on a sunny day. How does the shape of the object appear?

Pose the questions: Why does it form? How does it form?

- Children are invited to consider differences in shapes and colours of shadows and why these differences happen.

Shadows are presented by the teacher in a whole-group activity.

2. Inquiry (Designing and running experiments and observations)

Plan and conduct investigations in order to collect data

Investigation: 1. Explore and investigate how shadows are formed
Teacher explains to the children that they are going to do group investigations in groups of 4 about how shadows are formed.

Explain to the children that they are going to do group investigations into shadows are formed . They need to discuss together:

- which questions they would like to answer
- what they will do to try and answer these and in which order
- which materials they need/want to use
- how long they are going to take for each part of the investigation
- who will do what
- what they expect to see
- which findings are important to answer their question and how
- how they will record their findings
- how to present their ideas/findings to the whole class

Fair testing can be discussed if deemed appropriate for the age group; i.e. why it is important to keep the torch and object in the same place when comparing findings.

Teacher shows all available materials.

Possible options for questions to investigate:
Which objects make shadows? In this investigation children can use a torch to test whether a shadow is formed by different materials which are transparent, translucent as well as using colour filters e.g. different plastic colours.

How are the deepest shadows formed? Children are asked to form shadows from different objects and to study the type of shadow formed – is the darkness the same everywhere? What colour are the shadows of objects made of different colours of plastic material?
What happens to the shadow if the light source moves? Children test what happens to the size of shadows as the distance between object and the light source is changed. They do this by just noting how the size of the shadow formed changes.

Planning including identifying variables, prediction
Children explore using whatever materials and objects they choose to produce shadows and investigate how they are formed.

Teacher facilitates group works and asks questions

Recording, measure and describe – observation and recording the objects that do / don't create shadows; observation and recording changes in the shadows as the relationship between the light source and object alters

Teacher gathers whole class to discuss how to record observations (descriptions, drawings, tables / charts etc.)

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Teacher leads short session on:
How are you going to record what you find? What would be the best way(s) to record? I.e.

- Graphs
- Data tables
- Drawings
- Pictures
- Paragraphs/free writing
- Diary

Teacher selects what to discuss as appropriate for age group

Groups note results and present them to the rest of the class

Mini whole class plenary to discuss results before moving to next investigation

Investigation: 2. Explore and investigate how shadows alter over the day

- Children choose objects to use and at set points during the day to observe and record how the shadow of their shape has changed e.g. they can place a stick at a point in the yard and measure the length of its shadow at different times of the school day as well as draw the shape and orientation of the shadow
- They measure, draw and describe what it looks like
- At the end of the day, they compare and describe the shadows over the course of the day
- Groups compare how different shapes have given different results (especially opaque shapes)

Teacher helps with/facilitates this process.

Possible options for questions to investigate

- What happens to shadows during the day?
- How can the changes be useful to us?

Planning including identifying variables, prediction

Children work in groups to set up investigation and decide on where to place objects, when to record the shadow, how to record the shadow

Teacher elicits/presents ideas on how information might be recorded and described; which information is important?

Recording, measure and describe –observation and recording the changes in the shadows over a day

Teacher gathers whole class to discuss how children will record (e.g. drawing, description, measuring, length of shadow)

- Children record systematically over the day

Teacher goes round and assists/facilitates; makes sure all children or the group have recordings/descriptions of their investigation

Investigation (books/internet) to find out more information about sundials/shadow clocks etc. throughout the day.

3. Evaluation (Evaluating evidence)

Conclusion: use data to construct knowledge and generate evidence.
Demonstrate understanding of concepts and/or ability to use inquiry skills

For both activities separately:
Explanation of findings and evaluation
Plenary / whole class discussion of findings

- Group leaders present their findings to the whole class, which questions they asked and answers they got; their methods, their discoveries (surprises)? Next steps for investigation

Teacher encourages groups to comment on each other's methods and findings, to compare, give feedback – come up with a synthesis of the best practice. Top 3 of most interesting findings. Teacher also facilitates in terms of what questions could be asked, helping children note things they don't out if their own accord

Optional extension
Extending thinking/ creativity: Why is shadow important? What would it mean if there was no shadow? e.g. shadow creates day and night, and how shadows or the shade affects vegetation and animals.

Teacher facilitates a philosophical enquiry with the whole class – eliciting arguments and counter-arguments; syntheses of both; new questions; conclusion for now (sun as ultimate light source and life giver)

[This can be experimented with, i.e. the question can be asked before or after the investigation to measure the effect on the quality of the investigation and children's scientific enquiry based questions.]

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Materials in attachment: Teacher notes and subject knowledge, worksheets, concept cartoon

Considerations and subject background knowledge for the teacher

- How large should the groups be? Mixed ability or not? Should roles be assigned?
- Time of year - is the sun likely to shine? Prepare for alternatives
- Possible health & safety hazards (e.g. hot lamps)
- How much guidance do children need with each stage of the investigation
- Other adults needed
- Have questions ready to help children along
- Structured vs. open-ended: this is something to be considered. The worksheets are provided if teachers prefer a more guided lesson. If the teacher prefers to let the children decide about how to record their data, they can decide not to use the worksheets. Similarly, if teachers wish to focus more on the active part of the investigation than on writing, the worksheets can be skipped, or worksheets can be adapted to the age of the children or children with special needs.
- The activity is designed as a whole day, however it can be split in several sessions over several days if deemed more appropriate (although this is difficult with tracking the shadow over the course of the day, but measuring time can be made shorter)

Subject knowledge background

Light travels in straight lines from a source and it can be blocked from passing through an object by opaque materials (wood, metals, cork, cardboard, clay) causing shadows to form. Transparent materials allow light to pass through allowing a clear image of objects to be seen (cellophane, glass). Translucent materials allow light to go through, but we cannot see clear images (tracing paper, obscure glass, unpolished crystals). Shadows are created when light from a source falls on an opaque object. Because light travels in straight lines, there will be a lack of light in the area behind the object. The distance and position of light source and object will alter the shape and size of the shadow. The sun is the prime source of light and shadows that are cast on the ground by the Sun indicate its position in the sky. Thus time of day can be calculated by observing the alteration to the size of a shadow on the ground. The Earth revolves on its axis once every twenty four hours and when the sun is not shining on that part of the Earth i.e., absence of light creates darkness, giving us day and night.

Common misconceptions:

- Light only exists in bright areas (actually it travels in beams, even when you don't see it)
- Light does not travel at night time

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Shadows Worksheet

Which object or material did I use?	How thick is it?	Is it translucent, transparent or opaque?	Is there a shadow?		Drawing or picture of my shadow	You can write something about what the shadow looks like!
			I think there will/will not be a shadow (prediction) Why / why not?	Is there a shadow?		

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Shadows During The Day Worksheet

Time of day			
How thick is it?			
Is it translucent, transparent or opaque?			

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Shadows During The Day Worksheet

Time of day			
How thick is it?			
Is it translucent, transparent or opaque?			

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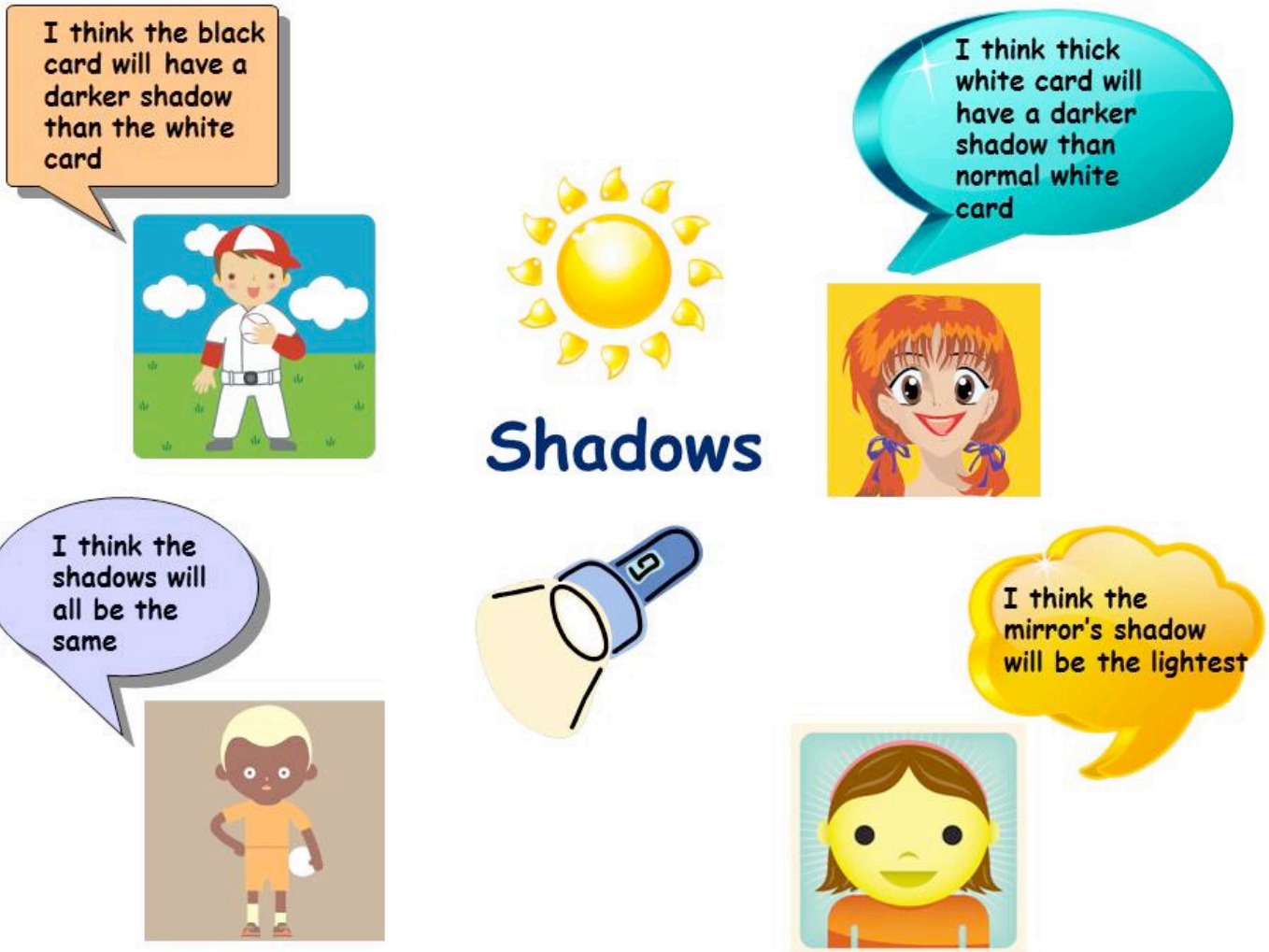

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